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DETAILED DESCRIPTIONS OF INDIVIDUAL MINES.

MINES OF NEWMAN HILL AND DOLORES MOUNTAIN.

ENTERPRISE MINE.

Situation.—This, which has been the most productive mine in the district, is situated on Newman Hill, about half a mile southeast of Rico, and about 400 feet above the town. It is reached from Rico by a wagon road, and by a short spur from the Rio Grande Southern Railroad.

Literature and history.—The Enterprise mine has been described in great detail by John B. Farish[1] and T. A. Rickard,[2] each of whom had charge of the development of the mine at different times, and wrote with the advantage which such experience gave. Since their descriptions were published many of the workings have become inaccessible, and all of the large stopes in the so-called "contact" have been allowed to cave in. Consequently the present account of the mine is indebted to these observers for many facts which it is no longer possible to verify.

The following historical account of the discovery and development of the mine is extracted from Rickard's paper:[3]

In the spring of 1881 David Swickhimer, Patrick Cain, and John Gault sunk a shaft 35 feet deep upon their Enterprise claim on Newman Hill. This work was undertaken not upon the evidence of ore, but in the expectation of cutting the continuation of the veins successfully worked in certain claims farther south, owned by the Swansea Gold and Silver Mining Company. Without entering into a detailed description of the geological structure of Newman Hill, it is necessary, in order to make the early story of discovery clear to the reader, to say that the true rock (sandstone and limestone) is overlain by drift, through which shafts must penetrate before reaching the ore-bearing formation. The veins do not reach the present surface, save in the face of the landslip where Harry Irving first detected them. The three owners above mentioned traded their claim to George S. Barlow for $300 worth of lumber. Barlow continued the sinking of the shaft to a depth of 146 feet. On an adjoining claim, named the Songbird, another miner, A. N. Waggener, sank a shaft to the depth of 203 feet. The latter penetrated through the drift into lime shale; but the Enterprise shaft did not at that time reach the true rock. Both shafts got into very wet ground. In the meantime the Swansea workings were reported to be impoverished and, finally, exhausted of ore. It was also said that the veins did not extend northward; but the real fact was that cross veins had faulted the ore-bearing veins in a manner to be rendered clear later on in this account. Newman Hill was discredited, and early in 1883 the Enterprise and Songbird shafts were abandoned.

A year later Larned and Hackett resumed work in the Swansea levels, and by mere accident discovered that the veins had not come to an end, but were simply dislocated. They prosecuted development, proved the continuity of the ore, and made large shipments. Their success induced Waggener and Barlow to relocate their abandoned claims late in 1886. But neither of them had any capital, and they

[1] On the ore deposits of Newman Hill, near Rico, Colo.: Proc. Colo. Sci. Soc., Vol. IV, 1892, pp. 151–161.

[2] The Enterprise mine, Rico, Colo.: Trans. Am. Inst. Min. Eng., Vol. XXVI, 1896, pp. 906–980.

[3] Loc. cit., pp. 909–912.

were unable to overcome the heavy flow of water. In December, 1886, David Swickhimer bought out Waggener's interest, acting on knowledge obtained while working in the Swansea mine, which had satisfied him that the veins must extend into the Enterprise and Songbird claims. In March, 1887, he recommenced the sinking of the Enterprise shaft. In May he acquired one-half of Barlow's interest. In July the windlass was replaced with a steam engine and a pump. All this time Larned and Hackett were driving rapidly northward, and threatened soon to reach the boundary separating their territory from that of Swickhimer and Barlow. Unless the two latter succeeded soon in finding a vein in place, so as to permit a valid location, the claims could be successfully disputed. They therefore hurried the sinking, and in spite of bad luck, floods of water, and a general lack of experience, they struck ore on the 6th of October at a depth of 262 feet. The first assay gave 2.1 ounces of gold and 519.4 ounces of silver per ton.

This ore was 1 foot thick, and formed part of a "flat lode." In the light of later developments this discovery is known to have been a piece of particular good fortune, for the maps of to-day prove that it was the edge of the biggest ore body ever found on Newman Hill, and that a shaft put down 20 feet farther east would have missed it. This was the first evidence of the existence of a flat ore deposit. Swickhimer thought at first that it was merely a roll in the Enterprise—an almost vertical vein. It was, however, soon proved by the workings to be a bedded formation, conformable to the inclosing country. The shaft was sunk 60 feet below this "contact," and a drift was run westward until the increased seepage of water in the following spring proved too much for the pump and caused work to be confined to the contact. In July the water diminished, drifting was resumed, and in August, at a distance of 118 feet southwest of the shaft, the Enterprise vein was at last intercepted. The ore was 20 inches thick and assayed 3.2 ounces of gold and 285.5 ounces of silver per ton.

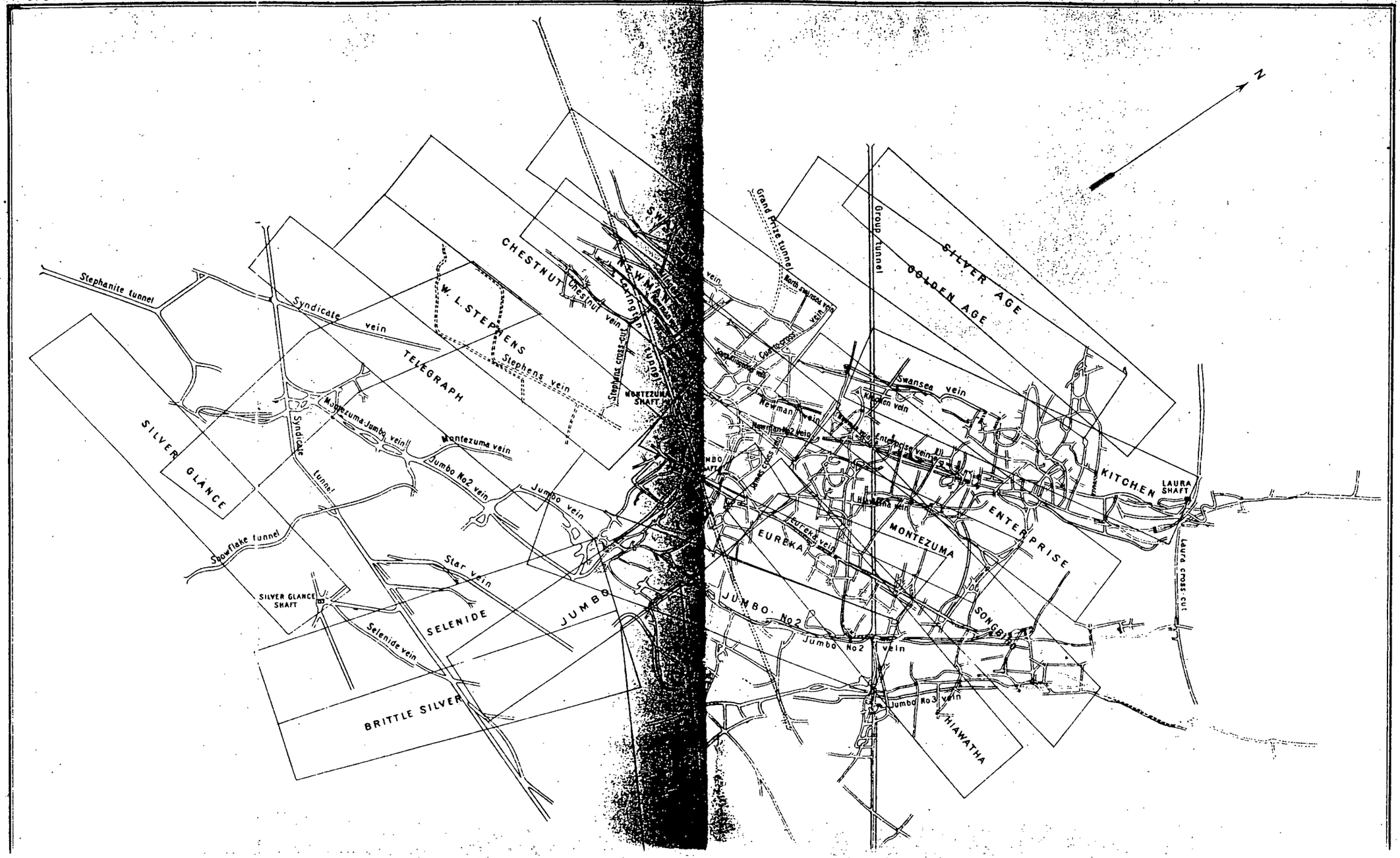
In May, 1890, the Songbird and Enterprise mines, together with much adjoining property, were acquired by the Enterprise Mining Company.

According to Rickard the workings in 1896 had a total length of 8 miles, and had yielded ore of the gross value of $3,500,000. In June, 1900, the workings had attained an aggregate length of 27 miles, according to Superintendent Percy S. Rider, and the total output had risen to about $4,000,000. The large increase in the extent of the workings and the proportionally small increase of the output are significant. The known "contact" ore bodies had been worked out, and in 1900 active mining for the time being had practically ceased.

Country rock.—The country rock of the Enterprise mine consists of sandstones, shales, and limestones of the lower division of the Hermosa formation (Upper Carboniferous) as described by Cross and Spencer. The total thickness of this division, exclusive of the porphyry sills, is estimated by these writers at about 800 feet, the Enterprise ore bodies occurring nearly midway between the top and bottom beds. The strata, as exposed in the Enterprise workings, have a general strike from N. 60° E. to N. 75° E. and dip southeasterly at from 10° to 15°. Local irregularities, however, are not uncommon, and the beds frequently dip to the southwest, as in the Group tunnel near the Enterprise vein, or even to the northwest.

Several partial sections of these beds have been measured and described. A generalized columnar section is given by Farish[1] in his

[1] Loc. cit., fig. 1.


N
SILVER AGE
GOLDEN AGE
Grand Prize tunnel
Group tunnel
Stephanite tunnel
Syndicate vein
W. L. STEPHENS
CHESTNUT
Chestnut vein
Stephens vein
Stephens cross-cut
MONTEZUMA SHAFT
TELEGRAPH
SILVER GLANCE
Syndicate tunnel
Montezuma-Jumbo vein
Montezuma vein
Jumbo No2 vein
Jumbo vein
Snowflake tunnel
Star vein
SILVER GLANCE SHAFT
SELENIDE
JUMBO
Selenide vein
BRITTLE SILVER
Swansea vein
Kitchen vein
Newman vein
Enterprise vein
KITCHEN
LAURA SHAFT
ENTERPRISE
MONTEZUMA
EUREKA
Eureka vein
Laura cross cut
JUMBO No2
SONGBIRD
Jumbo No2 vein
Jumbo No3 vein
HIAWATHA

Rickard remarks that the first class was mostly "contact" ore, while the second class represents the principal product of the veins.

The pyrite which sometimes occurs in the northwesterly lodes usually contains traces of gold and up to 8 or 10 ounces of silver per ton, but is never rich enough to work.

NEWMAN MINES.

Situation and history.—These, which in reality constitute but one mine owned by the Swansea Gold and Silver Mining Company, are also on Newman Hill and are worked through several adits about 1,000 feet south of the mouth of the Group tunnel and at nearly the same level as the latter. The general relation of the workings to those of the Enterprise mine may be seen from the combined plan forming Pl. XXXVI. It was from the Chestnut vein in this property that the first ore was shipped from Newman Hill in 1879, and this discovery led ultimately to the opening of the rich ore bodies in the Enterprise and Rico-Aspen mines. The Newman mines were worked actively in 1884, after a period of idleness, and have continued in intermittent operation to the present time. The blanket ore bodies, however, were not nearly so large as in the Enterprise, and of late years the mine has produced but little ore and has been operated on the leasing system.

Development.—The mines are worked through three principal levels known as the Chestnut, Klingender, and Swansea. All three communicate with the surface through adit tunnels opening on the steep hillside at slightly different elevations. There are in addition various minor drifts and crosscuts at other levels, and fairly extensive "contact" workings. A number of northeasterly lodes have been exploited, of which the more important are the Chestnut, Newman, Newman No. 2, Klingender, South Klingender, and Swansea. The Newman No. 2 is in all probability the same as the Enterprise vein.

Country rock.—In all that concerns country rock and general occurrence of the ore, the Newman mines are merely continuations of the Enterprise mine already described, and it is unnecessary to repeat those general descriptions. The general dip of the beds is about 15° a little west of south.

The lodes.—As in the Enterprise mine, these fall into two classes—the northeasterly veins, which carry workable ore for 200 feet or less below the contact, and the barren northwesterly lodes. The relations of these lodes to each other and to the overlying blanket are, in general those observed in the Enterprise, but there are many details obtainable in the Newman mines which can not be so easily seen in their larger neighbor. The northwesterly lodes in particular are not only well developed in the Newman workings, but have been drifted on for long distances, and have thereby been well exposed.

RICO-ASPEN MINE.

Situation and development.—This mine is situated on the southwestern slope of Newman Hill, just north of Deadwood Gulch. As shown on Pl. XXXVI, its workings are contiguous to those of the Enterprise and Newman mines. Large amounts of rich ore were produced subsequent to the purchase of the mine by the present company in 1891. This ore was obtained chiefly from the veins and "contact" workings in the northern part of the mine in ground at that time in dispute between this company and the Enterprise Mining Company. Of late years but little ore has been shipped, and that has been mined by a few leasers. All of the old "contact" workings and a large proportion of the drifts are no longer accessible.

Country rock.—This is the same as that found in the Enterprise and Newman mines, including the persistent bed of blanket limestone. The general dip is from 10° to 15° to the southwest. Inspection of the geological map (Pl. XLI) shows that this is also the dip of the strata near the mouth of Deadwood Gulch, the direction of strike swinging around to the west in accordance with the main domical structure, of which the town of Rico occupies almost the central point.

Access to the workings was formerly gained through five shafts—the Aspen, Vestal, Jumbo, Montezuma, and Silver Glance shafts. The present adit is the Syndicate tunnel, nearly 3,000 feet in length. For 900 feet the tunnel has a southeast course. It then turns about S. 73° E. and continues on this course to the face, which could not be reached in 1900 on account of the presence of gas. The Stephanite tunnel, which enters the hill just north of Deadwood Gulch, has a course of N. 72° E. for about 700 feet, and connects with drifts and crosscuts from the Syndicate tunnel. It is now caved in. The Syndicate tunnel is only a short distance below the blanket which comes down to this level at the Silver Glance shaft, a short distance south.

The lodes.—Owing to the condition of the workings no satisfactory study could be made of the lodes in the Rico-Aspen mine. They are for the most part, however, direct continuations of those worked in the Enterprise mine, and are of similar character. The Syndicate vein is the same as that known as the Stephens, farther northeast, and as the Eureka in the Enterprise ground. The Jumbo No. 2 appears to correspond with the Jumbo No. 2 in the Enterprise, and the Star is probably the Jumbo No. 3. The latter may, however, be represented by the Selenide vein. The exact relations of the Jumbo, Montezuma, and so-called Montezuma-Jumbo veins could not be ascertained.

The Selenide vein, which was being worked by leasers in 1900, has an average width of less than 6 inches and is usually frozen to the walls. It has a dip of about 85° to the northwest. It is filled with banded ore in every way similar to that already described in the northeasterly veins of the Enterprise mine.

stringers. It carries sphalerite, galena, and pyrite, and is low in grade. Above this vein, and resting upon the upper surface of the porphyry sheet, which dips to the south, is a "contact" carrying some ore. At the point first seen, this blanket is about 5 feet thick. At its bottom, resting upon the porphyry, is about 8 inches of crushed quartz containing sulphides—chiefly pyrite. Above this is 18 inches of soft shale breccia, then about 6 inches of disturbed black or dark-gray shale. Above this rests 2 to 3 feet of soft, gray, somewhat calcareous shales, which are crushed and disturbed and sometimes reduced to a gray clay. The top of the blanket was not visible at this point. The fragments of shale are usually impregnated with fine pyrite. There is not always a sharp line between the dark and light shales and the latter are, in part at least, bleached and altered forms of the former.

Above veins which enter it from below, the blanket breccia is frequently cemented and silicified by quartz carrying pyrite. In such cases the shale fragments can be recognized merely as siliceous blotches, of uncertain outline, surrounded by white quartz.

In the southern part of the workings the porphyry sheet can be seen dipping down at about 30° in a direction S. 25° E. Its contact with the shales is plainly an eruptive one, although the sheet in general follows the bedding planes. The blanket breccia does not always rest directly upon the porphyry, but is sometimes separated by a varying thickness of shale.

The blanket ore, of which not much was seen, consists chiefly of chalcopyrite, pyrite, galena, and sphalerite in a somewhat spongy quartz gangue. It is entirely different in character and much lower in grade than the ore of the Enterprise blanket, from which it is separated by fully 400 feet of strata. The two contacts are different, not only in character, but probably in origin.

UNION-CARBONATE MINE.

Situation.—Perched at an altitude of 10,400 feet on the northwest spur of Dolores Mountain, the shaft house of this mine is easily seen, on looking due east from Rico, as the highest of the mine buildings that dot Newman Hill. It lies just a mile east of the town in a straight line, but is reached by a road which zigzags up the slope of Newman Hill and passes over into Allyn Gulch.

History.—Work on the mine began in 1879, when two tunnels run in from the hillside struck the same ore body, and litigation followed. From 1880 to 1887 the mine lay idle. Then after spending some $25,000 at law, the contestants agreed to work the mine together. Operations were resumed, and ore was extracted until 1894. The total product has been about $100,000, although the workings are more extensive than in many mines which have produced several times that amount.

sometimes filled with a tough clay gouge, showing evidence of recent movement.

The ore of the upper blanket consists mainly of galena in various stages of alteration to cerussite and anglesite. It occurs in relatively small bodies alongside the vertical fissures. It is not known to occur in the limestone as a direct replacement.

The product of the mine is not known, but can scarcely have exceeded a few thousand dollars.

OTHER MINES.

Mediterranean tunnel.—This is on the south side of Allyn Gulch, at an elevation of about 9,800 feet. It runs in a southerly direction and has a length of about 1,500 feet. The country rock is the Lower Hermosa series of sandstones and shales, cut by several dikes and intruded sheets of monzonite-porphyry.

Owing to the gas in it, this tunnel could not be entered in 1900, but G. W. Tower, who examined the workings in 1898, has recorded the following section, measured northward from the breast of the tunnel out:

60 feet. Massive grits. Strike N. 60° W. Dip SW. 20°.
45 feet. Porphyry dike. Strike N. 60°. W. Vertical.
30 feet. Mineralized sediments.
00 foot. Barren fissure. Strike N. 55° E. Vertical.
45 feet. Porphyry. Strike N. 60° W. Vertical.
30 feet. Dark shale. Over this shale is a flat ore body. Strike N. 70° W. Dip SW. 10°.
84 feet. Massive, dark, hardened shale. In places the shale is impregnated with pyrite and chalcopyrite.
12 feet. Porphyry, dipping south and crossing the beds, 9 feet.
18 feet. In sediments to 6-inch vein. Strike E.–W. Vertical. Zinc and lead.
56 feet. Shales, to porphyry. Strike N. 70° E. Vertical.
12 feet. Porphyry. Strike N. 55° W. Vertical.
39 feet. Shales and sandstones. One small vein of quartz. Strike N. 75° W. This turns into the bedding planes of the strata and shows both vertical and horizontal movement.
00 foot. Narrow dike. Strike E.–W. Vertical.
12 feet. Grits, to fissure. Strike N. 60° W. Vertical, 1-inch fissure. The walls are coated with quartz and pyrite. There is also some impregnation of the adjoining country rock.
17 feet. Grits and shales, to fissure. Strike N. 57° W. Dip SW. 50°.
1 foot. Porphyry dike.
17 feet. Shales and sandstones, to mineralized fissure. Strike N. 70° E. Vertical. Eight inches of clay, cubical pyrite, and quartz.
21 feet. Impregnated grits, to fissure. Strike N. 55° W. Vertical.
18 feet. Porphyry.
00 foot. Mineralized fissure. Strike N. 83° W. Vertical. Breccia, containing pyrite and chalcopyrite; 3 feet wide.
32 feet. Sedimentaries.
18 feet. Porphyry dike. Strike N. 78° W. Crosses stratification at low angle.
6 feet. Grits, to vein. Strike N. 53° W. Vertical.

11 feet. Massive pyrite. Strike N. 70° W. Vertical. Crystals, 1 to 2 inches in diameter.
21 feet. Impregnated grits, to porphyry. Strike N. 45° W. Vertical.
39 feet. Porphyry.
60 feet. Sandstones and shales, to fissure. Strike N. 65° W. Quartz.
81 feet. Massive green sandstones, to fissure. Strike E.–W.
12 feet. Sandstones, to pyrite body over porphyry. Strike NE.
66 feet. Porphyry, to northwest fissure, in porphyry.
117 feet. Porphyry.
400 feet. Surface wash and débris to mouth of tunnel.

Sunflower mine.—This is also on the south side of Allyn Gulch, at an elevation of about 10,300 feet. The workings, consisting of a shaft and tunnel, are abandoned as inaccessible. Considerable work is reported to have been expended on a "contact" lying above those described in the Forest-Payroll mine.

Laxey mine.—This mine lies on the northern spur of Dolores Mountain, at an elevation of about 9,500 feet. It was idle in 1900 and was not visited. It has never been productive.

Pro Patria (Scoutt's) tunnel.—This tunnel enters the northwestern slope of Newman Hill at an elevation of about 9,450 feet. Its course is S. 31° E., and in the summer of 1900 it had reached a length of about 2,000 feet. It is an extensive prospecting venture, being designed to cut the northern extension of the lodes worked in the Enterprise ground and to explore the blanket or blankets in connection with them. The tunnel penetrates Lower Hermosa sediments and intrusive sheets and dikes of porphyry. The shales and sandstones have a general southerly dip. At the face massive beds of sandstone were found dipping to the southwest at an angle of 21°.

Several veins have been cut having general northeasterly or northwesterly courses. But at the level of the tunnel these are small, and carry little save quartz and worthless pyrite.

South Park mine.—The adit of this mine is a tunnel run into the northwest base of Newman Hill from the bed of Silver Creek. As the workings were abandoned in 1900, and the water dammed back in the tunnel, the mine was not entered. For a distance of about 500 feet, in monzonite-porphyry, the tunnel follows a fissure striking a little south of east, which Cross and Spencer have designated the South Park fault. Apparently, no ore was found in connection with this fault fissure. About 350 feet south of it, however, a nearly parallel vein is said to have made a small body of good ore at its intersection with a bed of dark shale about 7 feet in thickness. The ore is reported to have been about 12 feet wide. The vein itself also carried ore for a distance of about 20 feet above and below the shale horizon. The strike of the beds, which are low in the Lower Hermosa formation, is about N. 30° W., and the dip is southwesterly at about 25°.

in the quartzite, which shows a somewhat similar alteration to that already described.

The Smelter fault, as described by Cross and Spencer, must pass through or very near the upper tunnel of the Montezuma, but the workings themselves fail to reveal its presence.

CALUMET MINE.

This prospect is of interest through being on a vertical fissure, which is probably a branch of the Last Chance fault.[1] It is opened by a tunnel 500 feet in length, which enters about 1,000 feet south of Aztec Gulch and about 100 feet above the Dolores River. The vein is 4 or 5 feet in width, but without regular walls. It is filled with quartz, usually much crushed, containing bunches of pyrite.

The country rock near the mouth of the tunnel is fine-grained sandstone, changing near the breast to shale and intrusive porphyry. It is all more or less impregnated with pyrite and chalcopyrite, and the porphyry in particular is traversed by numerous minute stringers of quartz and pyrite and decomposed to a soft gray mass. Stringers containing quartz and pyrite and striking northwest and southeast are very numerous.

AZTEC MINE.

This mine, one of the first to be opened in the district, is situated in Aztec Gulch at an elevation of about 9,600 feet. It has been worked very irregularly for various short periods since 1879 and has made some small shipments of ore. About 24 tons were produced in 1895, which carried from $2 to $3 in gold and 17 ounces of silver per ton and 11 per cent of lead.

The developments are confined to some tunnels and small stopes on the Aztec lode. This strikes about N. 70° W. and dips north at from 80° to 85°. The country rock consists of shales, sandstones, and shaly limestones of the Lower Hermosa formation.

As exposed in the upper tunnel, the vein consists of white banded quartz, 3 feet in width, the banding being due to thin films of partly silicified gouge or shale inclosed in the quartz. This quartz is practically barren, containing only a little pyrite. On the footwall is a breccia of shale and shaly limestone about 2 feet wide, which passes without definite wall or gouge into the undisturbed shales and limestones forming the country rock (fig. 62). Both breccia and country rock are mineralized, chiefly with pyrite, to a distance of at least 5 feet from the vein. Much of this mineralization is a metasomatic replacement of calcareous shale bands similar to that described (fig. 60, p. 345) in the Union-Carbonate mine.

[1] Cross and Spencer, loc. cit., p. 120.